

Calorimetry Practice Problems

1. $Q_w = 200.0 \text{ g} \times 4.19 \times 6.0^\circ\text{C}$
 $= 5028 \text{ J}$
 $= 5.028 \text{ kJ}$

$\therefore Q_{\text{system}} = -5.028 \text{ kJ}$

$\Delta H = \frac{Q}{n}$

or $\frac{-37 \text{ kJ}}{1 \text{ mol}} = \frac{-5.028 \text{ kJ}}{x \text{ mol}}$

$\therefore n = \frac{Q}{\Delta H}$

↑
Mole coefficient of LiCl in balanced equation

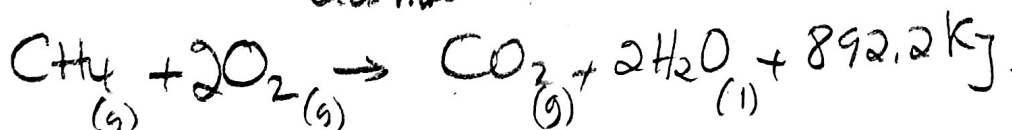
$n = \frac{-5.028 \text{ kJ}}{-37 \text{ kJ}} \Rightarrow n = 0.1359 \text{ mol}$

$m = 0.1359 \text{ mol} \times 42.39 \text{ g/mol}$ ← molar mass LiCl
 $= 5.8 \text{ g}$

2. $Q_{\text{absorbed by H}_2\text{O}} = 50.0 \text{ g} \times 4.19 \times 85^\circ\text{C}$
 $= 17843.125 \text{ J} \approx 1784 \text{ kJ}$

$Q_{\text{system}} = -1784 \text{ kJ}$

$\Delta H = \frac{-1784 \text{ kJ}}{2.00 \text{ mol}} = -892.2 \text{ kJ/mol}$



3. $n_{\text{C}_4\text{H}_{10}} = \frac{95.8 \text{ g}}{58.14 \text{ g/mol}} = 1.648 \text{ mol}$

$Q_{\text{system}} = ?$

or $\frac{Q}{n} = \Delta H$
 $Q = n \times \Delta H$

$\frac{1.648 \text{ mol}}{x \text{ kJ}} = \frac{1 \text{ mol}}{-2881.9 \text{ kJ}}$

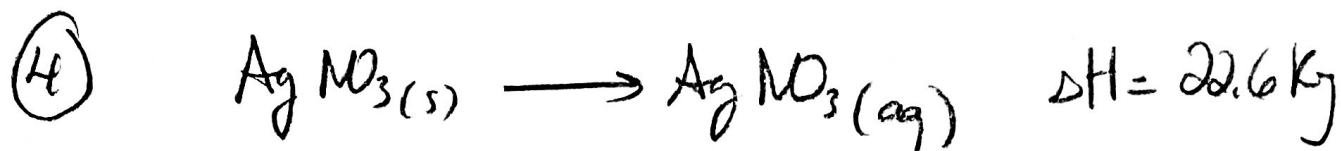
$x = 1.648 \times -2881.9$
 $= -4749.9 \text{ kJ}$

$Q_{\text{surroundings}} = +4749.4 \times 10^3 \text{ J}$

$\frac{4749.4 \times 10^3 \text{ J}}{4.19 \frac{\text{J}}{\text{g}^\circ\text{C}} \times 28^\circ\text{C}} = m$

$m = 40482 \text{ g}$

$m \approx 40.5 \text{ kg}$



$$n_{\text{AgNO}_3} = \frac{5.9 \text{ g}}{169.88 \text{ g/mol}} = 0.0347 \text{ mol}$$

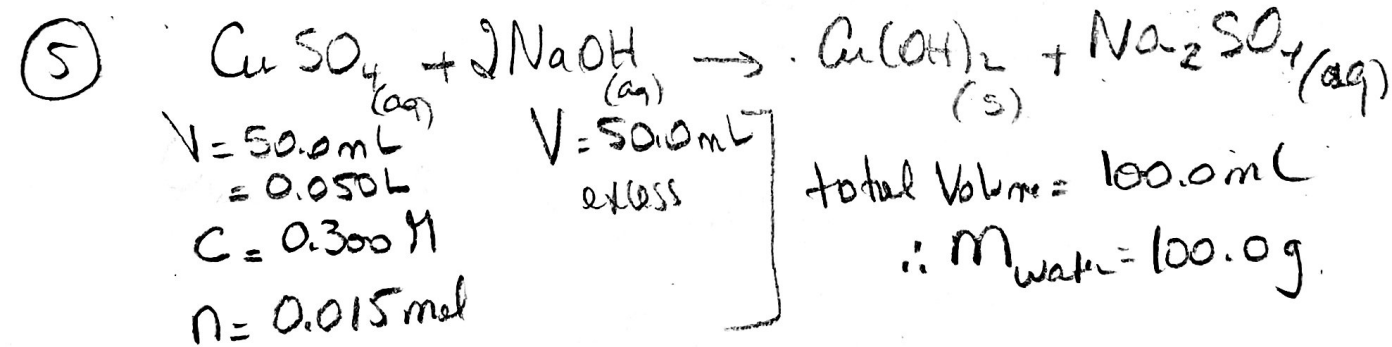
$$\frac{Q_{\text{system}}}{n} = \Delta H$$

$$\begin{aligned} \therefore Q_{\text{system}} &= n \times \Delta H \\ &= 0.0347 \text{ mol} \times 22.6 \text{ kJ/mol} \\ &= 0.785 \text{ kJ} \end{aligned}$$

$$Q_{\text{surroundings}} = -785 \text{ J}$$

$$-785 \text{ J} = 5.0 \text{ g} \times 4.19 \times \Delta T$$

$$\frac{-785}{5.0 \times 4.19} = \Delta T \quad \therefore \Delta T = 37.47^\circ\text{C} \approx 37^\circ\text{C}$$



$$\begin{aligned} Q_{\text{water}} &= 100.0 \times 4.19 \times (24.6 - 21.4) \\ &= 1340.8 \text{ J} \end{aligned}$$

$$\begin{aligned} Q_{\text{syst}} &= -1340.8 \text{ J} \\ &= -1.341 \text{ kJ} \end{aligned}$$

$$[Q = -1.34 \text{ kJ}]$$

$$\Delta H = \frac{Q}{n}$$

$$= \frac{-1.341 \text{ kJ}}{0.015 \text{ mol}}$$

$$= -89.4 \text{ kJ/mol}$$

Double check mole ratio

